ment of Dr. Bastian, in exceeding the point of saturation, even sensibly.[1]

The conclusion of my reply of July 17 last is then unassailable, consequently it is not accurate that Dr. Bastian has found the physico-chemical conditions for the spontaneous generation of bacteria.

We have examined experimentally, with not less attention, all the other points treated by Dr. Bastian in his papers of July 31 and August 21, subsequent to his original note of July 10. We are prepared to discuss them, but as they might distract attention from the main point of the debate we shall return to them later if convenient. One thing is of importance at the present moment, to know if Dr. Bastian is still convinced that urine, exactly neutralised by potash, yields microscopic organisms.

What we have said on the influence of solid potash may be repeated for liquor potassæ after it has been raised to 110°. But we wish to reply to-day to Dr. Bastian solely by the facts relative to solid potash, which suffice by themselves alone to condemn the conclusions which he has deduced from his experiments.

The reader will doubtless remark that in the preceding abstract we have scrupulously avoided introducing the word *germ* and opposing a doctrine to a doctrine. We have to do with a fact: Yes or no, does urine which has been boiled so as to be sterile, and better still, fresh, natural urine, just from the bladder, not having been submitted to any preliminary boiling—does this at 50° yield organisms after having been neutralised by potash? Dr. Bastian says yes, and this is his pretended great discovery. We say no, and we demonstrate by proving that Dr. Bastian would have obtained a result absolutely contrary to that which he published if he had made use of the substance KO,HO, which alone, in cases when it is pure or only associated with mineral matters in small quantity, has the exclusive right of being called potash.

The following reply to the above by Dr. Bastian was read at the Paris Academy, January 22[2]:—

At the *séance* of the Academy of January 8 M. Pasteur, in conjunction with M. Joubert, contributed another "Note sur l'Altération de l'Urine," in reply to the last communication which I had the honour of submitting to the Academy at its *séance* of August 21 of last year.

It may, perhaps, be permitted to me to state that an account of my researches on the fermentation of urine, much fuller than what has appeared in the *Comptes Rendus*, is now to be found in the *Proceedings* of the Royal Society No. 172, 1876; and to this paper I would particularly call the attention of all those who are interested in the question of the mode of origin of Bacteria and other related problems.

I have found, as stated in an earlier communication to the Academy, that previously sterile urine, when exactly neutralised by boiled liquor potassæ (of the British Pharmacopœia) will rapidly ferment and swarm with Bacteria, if the mixed fluids are maintained at a temperature of 50° C. M. Pasteur, after repeating my experiments with certain variations, said (*Compt. Rend.*, July 17, p. 178): "Je m'empresse de déclarer que les expériences de M. le Dr. Bastian sont, en effet, très-exactes; elles donnent *le plus souvent* les résultats qu'il indique." He then explains why he differs from me as regards the interpretation of these experimental results. It is somewhat confusing, therefore, to find M. Pasteur now saying in his most recent communication: "une seule chose importe en ce moment, c'est de savoir si le Dr. Bastian est toujours convaincu que l'urine neutralisée exactement *par la potasse* donne des organismes microscopiques?" My reply is simple. M. Pasteur has implied (*loc. cit.* p. 179) that solid potash heated only to 100° C. does lead to such an effect; I, however, have made no experiments with solid potash, though, in operating with the boiled liquor potassæ already named, I have many times obtained the result indicated, and am quite prepared to demonstrate to others the fact of the occurrence of fermentation in urine under these conditions.

In using solid potash M. Pasteur departed from the conditions of my experiments in a way which was wholly needless. It will be found much more convenient for others to repeat them exactly. Seeing that a strong solution of potash in suitable quantity can be easily heated in a closed glass tube to the temperature which M. Pasteur desires (110° C.), there is absolutely no reason for substituting solid potash as he has done. The *liquor potassæ* used by me has always been procured from Mr. Wm. Martindale, of 10, New Cavendish Street, London.

In his "Note" of July 17, the interpretation given by M. Pasteur of my results was that the liquor potassæ used by me immediately after it had been heated to 100° C. induced fermentation in the urine because it contained living germs not killed at this temperature of 100° C., but which would have been killed had the potash solution been heated to 110° C. M. Pasteur has strangely understood my meaning if he thinks, as he now intimates, that I have not contested the legitimacy of his reasoning. I am very far from regarding it as "irreproachable," and that for reasons which I have previously given. If, however, I have not been able to make myself understood it will be well for me to repeat the reasons on account of which I still absolutely reject M. Pasteur's interpretation. They are these:—(1) It is to me incredible that a fluid so caustic as the strong liquor potassæ which I have employed could contain living germs after it has been raised to 100° C., and it is not too much to ask that he who makes such an assertion should prove it; (2) that liquor potassæ (*when added in proper quantity to the urine*) is just as efficacious after it has been heated to 110° C. as when it has only been heated to 100°; (3) the decisive proof that liquor potassæ previously heated to 100° does not induce fermentation in sterile urine by reason of its containing living germs, is to be found in the fact that the addition of one or two drops of it only (when much more would be required for neutralisation), subsequently leaves the urine as barren as if no solution of potash had been added; whilst if the liquor potassæ really induced fermentation in the cases mentioned above (2) because of its containing living germs, then one or two drops of it would always suffice to infect any quantity of sterile urine to which they may have been added.

In his last communication to the Academy, M. Pasteur says:—"La question se trouve donc limitée à la connaissance de ce point:—Ai-je fait autre chose que de remplacer la potasse en solution par de la potasse fondue, et notablement, ai-je depassé le point de saturation de l'urine, et y a-t-il quelque inconvénient à le faire?" To these three questions I reply as follows:—(1) Yes, too much potash was also added; (2) Yes, in those experiments in which you obtained negative results, you expressly state that potash was added in quantity sufficient to render the fluid "alcaline" *Compt. Rend.* t. lxxxiii. pp. 179 and 377; (3) Yes, according to my experience, any amount of potash beyond what is sufficient to neutralise the urine in its unboiled state is decidedly prejudicial to the inducement of fermentation, and I have especially cautioned experimentalists on this subject (see *Proceedings* of Royal Society, No. 172, pp. 152 *note* †, and 155.

I would also call M. Pasteur's attention to the fact that in his last communication to the Academy, as printed in the *Compt. Rend.* for January 8, on the two occasions on which he professes to describe my experiment, he does it inaccurately. Thus, on p. 65, lines 2 and 3, and also on p. 66, in the sixth line from the termination of his note, he omits to mention the important fact that the added liquor potassæ was previously boiled.

Further discussion between M. Pasteur and myself seems to me in the present phase of the question to be almost useless. Certainly, no good can come from our alternate enunciation of opposite experimental results, when precisely the same methods have not been had recourse to. For my own part I am perfectly ready to reproduce before competent witnesses the results of which I have above spoken; or, failing this opportunity, I shall also be content patiently to await the ultimate decision of other properly informed fellow investigators, both here and on the Continent, as to the correctness of the facts which I have had the honour of announcing to the Academy.

[1] It is not useless to say here that, contrary to what is generally admitted, urea in aqueous solution or in urine is decomposed at 100° C. and even at temperatures much lower. The product of decomposition is carbonate of ammonia.

[2] On the Fermentation of Urine: Reply to M. Pasteur. By Prof. H. C. Bastian.

JOHANN CHRISTIAN POGGENDORFF

SCIENCE has lost one of her most diligent and devoted servants by the death of Prof. Dr. J. C. Poggendorff, in Berlin, on January 24. He was born in Hamburg on December 29, 1796. The early deaths of both parents forced him at a comparatively tender age to engage in the rougher conflicts of life; a circumstance which, however, contributed in a great measure to the rapid development and maturity of his

mental powers. At the age of sixteen he entered the establishment of a pharmaceutical chemist, and was actively engaged for eight years in this occupation. His hours of leisure were devoted to scientific study, and his aspirations gradually rose above the narrow limits in which he was confined. These longings were gratified in 1820, when he was enabled to enter the University of Berlin as a student of physics. With restless energy Poggendorff entered upon his chosen field and quickly gave evidences of more than ordinary talent. In 1821 Oken's *Isis* contained his first paper, "Physico-chemical Investigations upon the Magnetism of the Voltaic Pile." In this article he describes his discovery of the electro-magnetic multiplier or galvanometer, formed by carrying a wire several times round a magnetic needle in a vertical plane; an apparatus which with Schweigger's later improvements, is in universal use. Other articles on closely-allied subjects appeared at this period in Gilbert's *Annalen*. The abilities of the young physicist were soon recognised, and he received from the Royal Academy of Sciences at Berlin the post of "observator," which enabled him to continue his scientific investigations. The leading *savants* of the day—G. Rose, H. Rose, v. Buch, Alexander v. Humboldt, Mitscherlich, and others—gave him also a warm welcome into the circle of their friendship.

In 1824 Poggendorff conceived the plan of issuing a new physico-chemical journal on a more extensive basis than any other hitherto existing in Germany. The above-mentioned investigators, as well as Berzelius, Arfredson, Bonsdorff, and other prominent foreign chemists and physicists promised a hearty co-operation in the new enterprise. Before the completion of the preparations, the death of Prof. L. W. Gilbert, of Leipzig, who for twenty-five years had issued Gilbert's *Annalen der Physik*, left that periodical without an editor. Poggendorff entered at once into negotiations with the publisher. The result was that he edited the seventy-sixth and closing volume of Gilbert's series, and then issued the first number of the *Annalen der Physik und Chemie*. This was the decisive step of Poggendorff's life. Although but four years had elapsed since the commencement of his university studies, he brought to the new undertaking a breadth of knowledge, a keenness of discrimination, and a true love and enthusiasm for his work which, united with the warm co-operation of leading investigators, gave the *Annalen* at once a prominent position among scientific periodicals. The somewhat exacting duties of the new position did not prevent the continuance of his researches. In 1827 he invented the magnetometer for the measurement of minute magnetic variations. At this time, also, papers appeared from him on the vibrations of light, on the aurora borealis, on the law of diffusion of gases, on the decomposition of chemical compounds, on the relations between the elements of ternary compounds, &c., all of which evidenced a comprehensive grasp of the varied departments of chemistry and physics In 1834 he received the degree of Ph.D. from the University of Berlin, and in 1844 the degree of M.D. from the University of Königsberg. In 1834 he was elected to the position of extraordinary professor of physics at Berlin, in which relation he continued to the time of his death. The Royal Academy of Sciences at Berlin elected him to membership in 1839, and the most important of his subsequent researches were published in the *Transactions* of the Academy. These were confined almost exclusively to galvanism and electricity, and form altogether one of the most valuable and extensive contributions which has been made to our knowledge in this department. His labours were chiefly directed to the study of electro-chemical and thermo-electric phenomena, methods of measuring the intensity of the galvanic current, the laws of galvanic polarisation, the resistance of various conducting mediums, &c., as well as the invention of numerous pieces of apparatus applicable in this branch of physics. In 1837 Prof. Poggendorff was actively engaged with Liebig in the preparation of the first volume of the well-known "Handwörterbuch der Chemie," but was unable to continue his co-operation in the succeeding volumes. A series of biographical sketches, "Lebenslinien zur Geschichte der exacten Wissenschaften," appeared from his pen in 1853, and were followed in 1863 by a compendious "Biographisch-literarisches Handwörterbuch zur Geschichte der exacten Wissenschaften." This book of about 3,000 pages includes the biographies and fragments of works and papers of the scientific men of all nations and all times, and involved an immense amount of time in the preparation.

Valuable as were the experimental results and encyclopædic labours of Prof. Poggendorff, they assume a subordinate position by the side of the great life-work on which his energies were chiefly expended. In the long series of over 160 volumes of the *Annalen der Physik und Chemie*, he has left behind him the most enduring monument to his zeal and devotion in the cause of science. His rare combination of talents, his fine critical powers, his unflagging industry, and his long period of service render his scientific editorial career strikingly similar to that of the recently-deceased founder and editor of the *Revue des deux Mondes* in the world of politics and letters. The translation of the articles of foreign investigators formed no small part of his editorial labours. The seventy-six contributions of Faraday alone occupy between two and three volumes, those of Brewster and Regnault require each over a volume. It has been calculated that about one-fifth of the total number of volumes of the *Annalen* would be occupied alone with the editor's translations. The original plan of making the *Annalen* a complete record of all advances made in both chemistry and physics gradually became impossible, as the opportunities and incitements for original research increased. With the appearance of the various chemical serials in Germany, the department of chemistry became less and less prominent, until the *Annalen* has assumed an almost purely physical character.

Ever watchful to detect and recognise merit in fellow-labourers, he stood upon peculiarly intimate and friendly relations with a large proportion of his extensive staff of contributors. Their feelings of love and respect found opportunity for expression three years ago, when many of them gathered to celebrate the fiftieth anniversary of the foundation of the journal. The occasion was very fitly observed by the presentation to the aged editor of a jubilee volume of the *Annalen*, compiled under the direction of the contributors, and containing special articles from a number of leading physicists. The hope then expressed that it might be followed by many more volumes under his editorship was not destined to be fulfilled. He had reached his eighty-first year with unimpaired possession of mental and physical powers, when death suddenly removed him from his sphere of earnest, useful activity, after a brief and painless illness. A large assembly of men famous in literature and science, gathered at the burial ceremonies, to pay the last tribute to the memory of their departed friend. It is not alone in science that Poggendorff will be missed. His kindly, genial, appreciative disposition endeared him in the hearts of men from all classes of society; and the generous hospitality of his home will not easily be forgotten by those who have learned to know him in the midst of the family circle.

T. H. N.

THE NEW STAR IN CYGNUS

THE following three letters are published in *the Astronomische Nachichten*, Nos. 2115, 2116:—

On December 3 I received the news of the discovery of the new star in Cygnus, but the unfavourable weather did not allow me to search for it till the 5th.